

Application No.: 09/913,362
Amendment Dated: February 23, 2005
Reply to Office Action of: November 30, 2004

MAT-8172US

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A non-contact position sensor comprising:

a plurality of magnets forming a magnetic circuit so that a continuous magnetic flux flows from one of said magnets, to and through another of said magnets, and back to and through said one of said magnets;

at least one magnetic sensor element within said magnetic circuit; and

an object to be detected, said object positioned in said magnetic circuit in a space between said one and said another of said magnets, said magnetic sensor element remains stationary while said object moves.

said magnetic circuit comprising a U-shaped first magnetic body, a U-shaped second magnetic body, and two magnets included in said plurality of magnets,

said two magnets are disposed between said two U-shaped magnetic bodies arranged vertically, and

said magnetic sensor element is held by said two U-shaped magnetic bodies.

2. (Withdrawn) The non-contact position sensor according to claim 1, wherein said magnetic body includes a discontinued portion, and said object to be detected is positioned in any one of said discontinued portion, and between said discontinued portion and one of said magnets.

3. (Withdrawn) The non-contact position sensor according to claim 1, wherein said magnetic body comprises two magnetic bodies, each having generally an L-shaped tip end, and

said magnetic sensor element is disposed to the tip end of at least one of said two magnetic bodies.

4. (Withdrawn) The non-contact position sensor according to claim 1, wherein

said magnetic body has one magnetic pole of one of said magnets disposed to generally a center portion thereof, said magnetic body has L-shaped tip ends at both ends thereof, and

said object to be detected is disposed in a position among said one magnetic pole, an opposite pole of one of said magnets and the tip ends of said magnetic body.

5. (Withdrawn) The non-contact position sensor according to claim 1, wherein

said magnetic circuit comprises a magnetic body of magnetically closed circuit and said plurality of magnets includes two magnets disposed to an inside of said magnetic body of closed circuit,

said magnetic sensor element is disposed to the inside of said magnetic body of closed circuit,

and said object to be detected is positioned between said two magnets.

6. (Withdrawn) The non-contact position sensor according to any one of claim 1 to claim 5, wherein said object to be detected has a cross section of any one of a sectorial shape, semicircular shape and I shape.

7. (Withdrawn) The non-contact position sensor according to any one of claim 1 to claim 4, wherein a tip end of said magnetic body is slanted with respect to an axis connecting an N-pole and an S-pole of one of said magnets.

8. (Withdrawn) The non-contact position sensor according to claim 5, wherein

said magnetic body has a portion having a thickness smaller than the other portion, and

said magnetic sensor element is disposed to said portion of smaller thickness.

9. (Withdrawn) The non-contact position sensor according to claim 5, wherein the portion of said magnetic body where said magnetic sensor element is disposed has a stepped level of different plane from the other portion.

10. (Withdrawn) The non-contact position sensor according to claim 5, wherein a lateral distance of each said two magnets is generally equal to a diameter of said object to be detected.

11. (Cancelled).

12. (Currently Amended) The non-contact position sensor according to claim 11, wherein the portion of each said U-shaped magnetic bodies where said magnetic sensor element is disposed has a stepped level of different plane from the other portion.

13. (Previously Presented) The non-contact position sensor according to claim 12, wherein the portions of said U-shaped first and second magnetic bodies where said magnetic sensor element is disposed are in contact to each other via said magnetic sensor element.

14. (Currently Amended) ~~The non-contact position sensor according to claim 11, A non-contact position sensor comprising:~~

a plurality of magnets forming a magnetic circuit so that a continuous magnetic flux flows from one of said magnets, to and through another of said magnets, and back to and through said one of said magnets;

at least one magnetic sensor element within said magnetic circuit; and

an object to be detected, said object positioned in said magnetic circuit in a space between said one and said another of said magnets, said magnetic sensor element remains stationary while said object moves;

wherein at least one of said two U-shaped magnetic bodies has a shape that at least partially conforms with an external shape of said object to be detected.

15. (Withdrawn) ~~The non-contact position sensor according to claim 11, A non-contact position sensor comprising:~~

a plurality of magnets forming a magnetic circuit so that a continuous magnetic flux flows from one of said magnets, to and through another of said magnets, and back to and through said one of said magnets;

at least one magnetic sensor element within said magnetic circuit; and

an object to be detected, said object positioned in said magnetic circuit in a space between said one and said another of said magnets, said magnetic sensor element remains stationary while said object moves, wherein

each of said two U-shaped magnetic bodies has stepped planes, and

said two magnets confront each other at different planes.

16. (Withdrawn) ~~The non-contact position sensor according to claim 11, A non-contact position sensor comprising:~~

a plurality of magnets forming a magnetic circuit so that a continuous magnetic flux flows from one of said magnets, to and through another of said magnets, and back to and through said one of said magnets;

at least one magnetic sensor element within said magnetic circuit; and

an object to be detected, said object positioned in said magnetic circuit in a space between said one and said another of said magnets, said magnetic sensor element remains stationary while said object moves, wherein

each of said two U-shaped magnetic bodies further has a magnet supporting section, and

said two magnets confront each other at different planes.

17. (Withdrawn) The non-contact position sensor according to claim 1, wherein

said magnetic circuit comprising a U-shaped first magnetic body, a U-shaped second magnetic body of a greater size than said first magnetic body, and two magnets of said plurality of magnets,

said two magnets are disposed between said two U-shaped magnetic bodies, and

said magnetic sensor element is disposed within a U-shaped space of said U-shaped first magnetic body.

18. (Withdrawn) The non-contact position sensor according to claim 17, wherein said U-shaped first magnetic body and said U-shaped second magnetic body are disposed to a same plane.

19. (Withdrawn) The non-contact position sensor according to claim 17, wherein said U-shaped first magnetic body and said U-shaped second magnetic body are disposed generally perpendicularly with respect to each other.

20. (Withdrawn) The non-contact position sensor according to claim 19, wherein said U-shaped second magnetic body has an aperture formed in generally the center thereof for receiving an insertion of said object to be detected.

21. (Withdrawn) The non-contact position sensor according to claim 19, wherein said U-shaped second magnetic body comprises two parts, and

contacting sides of said two parts form a portion for receiving an insertion of said object to be detected.

22. (Withdrawn) The non-contact position sensor according to claim 1,A non-contact position sensor comprising:

a plurality of magnets forming a magnetic circuit so that a continuous magnetic flux flows from one of said magnets, to and through another of said magnets, and back to and through said one of said magnets;

at least one magnetic sensor element within said magnetic circuit; and

an object to be detected, said object positioned in said magnetic circuit in a space between said one and said another of said magnets, said magnetic sensor element remains stationary while said object moves, wherein

said magnetic circuit comprising a U-shaped first magnetic body, a U-shaped second magnetic body, and two magnets,

said two magnets are disposed between said U-shaped first and second magnetic bodies arranged vertically,

said magnetic sensor element is disposed to a generally center portion between said U-shaped first and second magnetic bodies, and

said object to be detected is disposed in a linearly movable manner between both ends of said U-shaped first magnetic body and both ends of said U-shaped second magnetic body.

23. (Withdrawn) The non-contact position sensor according to claim 22, wherein

one side arm of said U-shaped first magnetic body has a width generally equal to a width of one side arm of said U-shaped second magnetic body,

another side arm of said U-shaped first magnetic body has a width generally equal to a width of another side arm of said U-shaped second magnetic body, and

a detectable distance of said object to be detected equals to a distance derived by subtracting a length of a detective section of said object from the sum of the width of said one side arm, the width of said another side arm, and a space between said one side arm and said another side arm.

24. (Withdrawn) The non-contact position sensor according to claim 23, wherein the length of said detective section is longer than any of the width of said one side arm and the width of said another side arm.

25. (Withdrawn) The non-contact position sensor according to claim 22, wherein a portion of any of said U-shaped first and second magnetic bodies where

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said magnetic sensor element is disposed has a stepped level of different plane from the other portion of said U-shaped first and second magnetic bodies.

26. (Withdrawn) The non-contact position sensor according to claim 25, wherein the portions of said U-shaped first and second magnetic bodies where said magnetic sensor element is disposed are in contact to each other via said magnetic sensor element.

27. (Previously Presented) The non-contact position sensor according to claim 1, wherein said magnetic flux passes through the object from one magnet to another.

28. (Currently Amended) The non-contact position sensor according to claim 111, wherein said magnetic flux passes through the object from one magnet to another.

29. (Previously Presented) A non-contact position sensor according to claim 1, wherein said one magnet oriented with reserve polarity relative to said another of said magnets.